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DEPARTMENT OF LAND RECORDS AND AGRICULTURE.

REPORT

OF THE

DEPARTMENT OF AGRICULTURE,

BOMBAY PRESIDENCY,

FOR THE YEAR

1903-1904.

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1904.

Errata slip to the Report of the Department of Agriculture, Bombay Presidency, for the year 1903-04.

Page 3, para. 11, line 5—*for* the words "West of Dharwar" *read* "East of Dharwar."

Page 8, para 25, line 17—*for* "corocana" *substitute* "coracana."

No. A/6652 of 1904.

From

H. S. LAWRENCE, Esquire, I. C. S.,
Director, Land Records and Agriculture, Bombay,
Poona;

To

The CHIEF SECRETARY to GOVERNMENT,
Revenue Department, Bombay.

Poona, 26th October 1904.

Sir,

I have the honour to submit herewith the Annual Report of the Department of Agriculture for the year 1903-1904 prepared in accordance with the orders contained in Government Resolution No. 5509, dated 18th July 1904.

CHAPTER I.

Prefatory.

2. I was in charge of the Department throughout the year. Provincial revenues having been relieved to some slight extent from the severe financial strain of recent years, the opportunity was taken of effecting a considerable development of the work of the Department. Mr. Mollison, Inspector-General of Agriculture, twice visited the Presidency. The programmes of cultivation on the several farms were prepared with his approval; and his advice and assistance have always been freely given and have been of the greatest value.

3. In August 1903 a memorial advocating the further development of agricultural and botanical research was submitted by an influential body of gentlemen, European and Native, from the City of Bombay and all parts of the Presidency. Definite proposals regarding the development of the Department that was immediately possible were submitted in a joint report by Mr. Mollison and myself in November. In the preparation of this report we had the advantage of consulting the gentlemen whose names are mentioned in the margin, who were at the time visiting this Presidency on a tour of inspection of the farms. The advice of this independent body of agricultural experts was of great assistance to us, and we were fortunate in securing their approval to the scheme submitted to Government. The proposals made are still under the consideration of Government since the final sanction of the Secretary of State is necessary to their adoption, but considerable progress has been made in taking the measures that would in any case be necessary in preparation for the further development contemplated.

F. G. Sly, Esquire, Director, Land Records and Agriculture, Central Provinces.
W. Renouf, Esquire, Director, Land Records and Agriculture, Punjáb.
C. Benson, Esquire, Deputy Director of Agriculture, Madras.
C. A. Barber, Esquire, Botanist to the Government of Madras.
Dr. Lehmann, Agricultural Chemist to the Mysore Government.
Dr. Butler, Cryptogamic Botanist to the Government of India.
H. M. Lefroy, Esquire, Entomologist to the Government of India.

Much benefit was derived from the consultation of officers with experience of other provinces of India, and the comparison of the lines of work that are being pursued elsewhere.

4. At the opening of the year Mr. P. R. Mehta, M.R.A.C., was acting Deputy Director of Agriculture, and Mr. J. B. Knight, M.Sc., Mass. College, United States, America, was on special duty in connection with the revision of agricultural text-books.

Mr. Fletcher, M.A., of the Cambridge University joined the Department in September 1903 as permanent Deputy Director and on 17th January 1904 Mr. Mehta was relieved of his employment in this Department.

5. Mr. Fletcher on arrival found himself confronted with a great mass of work and his responsibilities were rendered the more onerous by reason of the great distances which separated his several spheres of work. He has applied himself to his duties with great energy. He visited Sind in December and on his report that conditions were favourable to the growth of Egyptian cotton in that province measures were organized for an important experiment which was commenced in the spring and which at the time of writing gives great promise of success. The successful conduct of these measures in the Thar and Párkar District in spite of considerable difficulties in regard to the water-supply was very creditable to an officer without previous experience in India. At the same time Mr. Fletcher supervised the farm at his head-quarters at Surat, organised and started work on the new farms sanctioned at Nadiád and Dhárwár, and commenced a new series of cotton experiments at Jalgaon in Khándesh. The fact that from Thar and Párkar to Dhárwár the journey by railway is over 1,200 miles indicates the difficulty experienced in exercising satisfactory supervision over so many branches of work in different localities.

6. Mr. Knight continued on duty throughout the year and was placed in charge of the head-quarters farms at Poona and Mánjri and from January 1904 took up the duties of Professor of Agriculture in the College of Science. Mr. Knight has worked with great zeal and has rendered very valuable service in regard to each branch of duty that was entrusted to him. His knowledge of entomology was particularly useful in the conduct of investigations into the life history of the Bombay locust.

7. Mr. Mehta was employed for three months in assisting Mr. Fletcher to acquire a knowledge of Indian conditions of agriculture and official procedure. He also prepared a text-book for training Colleges on the basis of Mr. Mollison's Indian Agriculture, and took part in an enquiry into water-logging on the Nira Canal. His work was performed with his usual industry and intelligence.

8. In the course of my enquiries in connection with the Land Records, Survey and Settlement, and Registration matters I visited 16 districts and some States in Káthiáwár, five districts being visited twice and four districts three times. *Inter alia*, the following subjects of agricultural enquiry occupied my attention, and have been the subject of special reports.

1. The proposals of the Government of India for the substitution of a vernacular course in place of the English course of agricultural education at the College of Science, Poona.

2. The improvement of the agricultural teaching at the College of Science, Poona.

3. Preparation of a scheme of agricultural development.

4. Arrangements for the growth of Egyptian cotton in Sind.

5. Experiments with ráb manuring in the Ghát country.

6. Reservation of land for future farms in connection with irrigational projects now under contemplation.

7. Extraction of fibre from agave plantations.

8. Locust plague.

9. Establishment of cattle breeding or rearing farms.

10. Separation of horse-breeding operations between the Army Remount Department and the Civil Veterinary Department.

11. Re-organization of the subordinate Veterinary Department.

12. Conditions of Pátasthal irrigation in the Deccan.

13. The condition of Bhátha cultivation in Gujarát.

14. Water-logged areas on (1) the Nira Canal in Poona, (2) in Khándesh and (3) in Broach.

CHAPTER II.

Agricultural Farms and Special Enquiries.

9. In August 1903 the following farms were in charge of the Department and in working order :—

(1) Poona, (2) Mánjri, (3) Surat.

Land had been acquired for a new farm at Nadiád in substitution for a small area which had previously been in charge of the local Agricultural Association.

Small experimental plots had also been temporarily acquired at Chhárodi in the Ahmedabad District and at Dhulia in the Khándesh District for the cultivation of cottons and jowári. Arrangements had also been made for experiments in the application of nitre to rice lands in the occupation of cultivators in the Poona, Thána and Surat Districts.

A detailed account of the cultivation on these farms will be found in the Annual Report which has been separately published and of which a brief summary is appended to this report (Appendix A). Experiments were continued on the lines already laid down on the three old established farms and in addition several new branches of work were undertaken.

Nadiád.

10. At Nadiád the conversion of 44 acres of agricultural fields into a model experimental farm was satisfactorily effected and a complete set of farm buildings was constructed.

Acknowledgments are due to the Nadiád Agricultural Society and in particular to the President, Mr. Desái, for their cordial co-operation in all matters concerned with the changes made.

Dhárwár.

11. Proposals were laid before Government for the establishment of a farm at Dhárwár for the study of the conditions of agriculture in the Southern Marátha Country and in particular of possible improvements in the cultivation of cotton. A site was selected three miles west of Dhárwár. Seventy-three acres were acquired on lease and much progress was made in levelling and laying out the land in suitable plots. Plans and estimates have been prepared for the farm buildings necessary, which are now in course of construction and cultivation has been commenced.

Chhárodi and Dhulia.

12. The experiments on these two stations were successfully conducted; those at Chhárodi are being repeated, but it has been found that Dhulia was not an entirely satisfactory location and the further experiments in regard to the Khándesh District are now being carried on at Jalgaon, which is situated in the centre of the cotton tract and is more accessible for the purpose of supervision.

In the Khándesh District alone cotton covers an area of a million acres and the varieties there grown stand in great need of improvement. As Mr. Fletcher points out, it is necessary that experiments in the hybridization of these varieties should be conducted in the district in which they are grown.

Nitre.

13. The experiments with nitre, though promising, are not regarded as conclusive and are being repeated in this season.

Ráb.

14. A further important and interesting line of inquiry has been taken up in regard to the system of ráb in the Ghát country. Investigations conducted by Mr. Ozanne in 1886—88 established the undoubted value of this system of cultivation in increasing the yield of rice in regions of heavy rainfall. But the continuous depletion of ráb materials is a serious menace to the future prosperity of agriculture in this tract and enquiries are being conducted by Mr. Knight, at Lanowli, in order, if possible, to ascertain some alternative method of manuring that may be equally effective for the purpose. Some 20 plots of land have been treated with different manures for comparative test. It will however of course be necessary to continue the experiments for several seasons before a definite result can be arrived at.

15. The experiments in the application of an effluent from septic tanks obtained from the sewage of the Poona City were continued and with the experience gained in the previous year the results were somewhat more satisfactory. The application of the sewage requires to be very carefully regulated and the crops which are able to absorb it satisfactorily must be selected by experience. It has been ascertained that yams (*Dioscorea sativa*) and surans (*Amorphophallus campanulatus*) grow so rankly as to become unfit for consumption, while ginger and turmeric thrive and in no way deteriorate. The effluent is a valuable manure for sugarcane provided the applications are carefully watched and regulated according to the growth and condition of the crop, and on fodder crops of jowári and maize it has a remarkably forcing effect.

Septic effluent and sewage Farms.

16. A report on the final results of the three years' experiments which have been conducted will shortly be submitted to Government. Though useful knowledge has been acquired, it is not possible to base definite conclusions regarding the effect of an effluent from the whole sewage and drainage of a city on the experiments conducted with an artificial mixture prepared on a special plan. If reliable data are to be obtained, it is necessary to introduce a drainage system into a village or portion of a city, and to experiment with the effluent derived from septic tanks working under actual conditions.

17. An inconclusive experiment was also made at Surat with the Meagher system of trenching which has been reported to be successful in the Central Provinces and it has been suggested to Municipalities to conduct similar experiments.

The sewage farms at Karáchi and Ahmedabad have been watched with interest. In Karáchi local conditions enable the direct application of enormous quantities of crude sewage to the soil to be made with most satisfactory results. In Ahmedabad the same system has been adopted, but owing to the small area of land taken up it has not had a fair trial. Both these experiments are under the complete charge of the Municipalities.

18. Experiments were for many years conducted on these gardens which are recorded in the Poona volume of the Bombay Gazetteer, but since 1883 when the operations were transferred to the Empress Gardens the Ganeshkhind gardens had remained waste and unutilized. In July 1903 I placed them in the charge of Mr. Gammie, Professor of Botany at the College of Science, and Government have recently sanctioned an application for a grant of Rs. 5,000 per annum for their maintenance. The following programme of work has been prepared and good progress has been made at the commencement.

Botanical Gardens at Ganeshkhind.

Programme of work.

1. A systematic collection of indigenous trees and shrubs to determine (among others) the following facts.

I. The most satisfactory methods of reproduction, transplanting and treatment during growth.

II. The periodical increment of growth.

III. Periods of leafing, flowering, fruiting and ripening of seed.

IV. Age of maturity.

V. Special investigations regarding the quality of timber, yield of other economic products, &c.

2. Experimental introduction of rubber, fibre, medicinal plants, &c.

3. Experimental tests on exotic plants on the same lines as (1) and (2).

4. Endeavours to improve and increase the yield of fruit trees, indigenous and also exotic if found suitable for the Deccan.

5. Botanical research in certain special natural orders, the first three to be undertaken being *Malvaceæ*, *Leguminoceæ* and *Cucurbitaceæ*.

6. To continue the cultivation of cottons for purposes of botanical classifications.

7. To attempt the improvement of a selected number of our finest wild flowering plants. This line of investigation has been neglected in India.

This work has been undertaken by Mr. Gammie purely as a volunteer and I wish to acknowledge the obligation of this Department to him both in regard to this work and to the botanical identification of wheats and cottons which he has also voluntarily undertaken on the Kirkee and Mánjri farms. The Department will be fortunate if it is able to secure Professor Gammie as one of its whole time officers.

Cotton experiments in Sind.

19. Experiments in the introduction of different varieties of cotton into Sind have been frequently conducted from time to time but without success. In June 1903, Mr. M. D. Mackenzie, Deputy Commissioner of Thar and Párkar, who had long taken a keen interest in such experiments, reported that he had successfully introduced a new and more valuable variety known as Comilla. This cotton has a rough and short staple which renders it suitable for mixture with wool for which purpose it is exported to Germany and commands a comparatively good price. I recommended Mr. Mackenzie to make further efforts to introduce higher grades of cotton and as soon as Mr. Fletcher had made a round of the farms in the Presidency I sent him in December to inspect Mr. Mackenzie's experimental plots. Mr. Fletcher found a small area of Egyptian cotton which gave great promise of success and recommended the immediate conduct of further experiments. These proposals were submitted to Government and approved. Funds were promptly provided, and when I visited Sind in March the Commissioner convened and presided over a meeting of Irrigational and Revenue Officers to consider the selection of land and the provision of irrigation. Hitherto the short period between the commencement of the inundation and the arrival of the winter frosts has condemned the Sindhi to the cultivation of cotton of a very inferior staple. On inundation canals he was not able to sow before May or June and in order to save the cotton from being destroyed by frost he had to sow a short staple variety which would come to maturity within five months. Cottons of finer quality and longer staple however invariably require a longer period of growth and it is to the extension of perennial irrigation in Sind that we must look to enable the cultivation of superior varieties. The perennial canals already in existence command an area of not less than $1\frac{1}{4}$ million acres and on these canals it is possible to sow long stapled cotton of the Egyptian or other varieties in February or March and to allow it time to come to full maturity in October or November.

20. With the assistance of Mr. Chatfield, the Colonization Officer on the Jámráo Canal, Mr. Fletcher obtained a site of some 20 acres on the Hiral Wah at Dhoro Naro in the Thar and Párkar District, and although he was only able to sow the cotton in the middle of April and the experiment was endangered by the uncertainty of the water-supply and by the severity of the hot winds which threatened to scorch the plants before they were firmly established, the first pickings have at the time of writing yielded a very heavy return of cotton of excellent quality which has been valued by experts as equal or superior to the best Egyptian cotton imported into this country. The experiment will be repeated on a larger scale in a more suitable location at Mirpur Khás in the coming year.

It is, I venture to think, very satisfactory to note that though the project was only put forward by Mr. Fletcher in a report dated December 23rd, the necessary funds were provided by Government, the consent and co-operation of the numerous officers concerned both of the Revenue and Irrigational Departments was obtained, a site was selected and laid out and cultivation was commenced within a period of four months.

21. A serious difficulty which threatened to obstruct the project consisted in the practice of the Irrigational Department in closing the Jámráo Canal for clearance in the months of April and May. My cordial acknowledgments are due to Mr. Muir-Mackenzie, Commissioner in Sind, for his valuable co-operation in securing a modification of this practice, and the results that will be obtained in October 1905, from the Egyptian cotton sown at Mirpur Khás in February next will, it is believed, be of remarkable interest and importance to the Province of Sind and possibly to the mill industry of the Bombay Presidency.

22. In connection with the schemes under consideration for the improvement of cotton I have the honour to invite the attention of Government to the valuable remarks contained at the commencement of Mr. Fletcher's report which has already been published in the Annual Report on experimental farms. Since a more general survey of the cotton question as it affects this Presidency may possibly be of some interest I venture to subjoin a note which I prepared at the time of the initiation of these experiments in Sind.

Note on the possibilities of the extension of area and improvement in quality of cottons grown in the Bombay Presidency.

In all India there are 16 million acres under cotton. Of this area, 5 million acres belong to Bombay, 3 million being in British Districts and 2 million in Native States under the Government of Bombay.

2. The total outturn of all India is 2¾ million bales, and of the Bombay Presidency 1 million bales.

The present export may be taken at 1,600,000 bales, of which England takes 100,000 bales, while the Continent takes 1 million, and China and Japan half a million.

3. The cotton of the Bombay Presidency is commercially classified under eight varieties (*vide* statement B of the forecast return annually published). These eight varieties however fall into groups—

A.—Broach, Kumpta and Dhárwár which have a long staple and take eight months to arrive at maturity.

These cover 2 million acres and produce 350,000 bales.

B.—Khándesh and Gujarát varieties, which have a short staple, but arrive at maturity in five months.

These cover 3 million acres and produce 600,000 bales.

Sind with 200,000 acres comes under group (B), but will be considered separately.

4. As regards improvement and extension I will take groups A and B and Sind in turn.

Group A.

5. *Improvement.*—These are the best varieties in India: they can spin counts up to and sometimes over 30; they usually command a price of Rs. 110 per bale of 400 pounds and this year have touched Rs. 174.

The methods of cultivation in vogue are already good; and it is hoped that some improvement in staple and outturn may be effected

(*a*) by teaching the importance of selection of seed,

(*b*) by hybridization amongst allied species.

A Government farm exists at Surat and is just being established at Dhárwár for these objects, but it may take some years to achieve any appreciable result.

6. *Extension.*—There is very little room for any extension of area under cotton in these districts, certainly not more than 300,000 acres with an outturn of 50,000 bales. But this extension could only take place if the prices of cotton are maintained at a level approaching the present.

Group B.

7. *Improvement.*—These short stapled varieties spin counts of 12 and 15 and sell usually at Rs. 90 per bale and this year at Rs. 130.

Their cultivation in the Khándesh and Gujarát Districts is determined by the conditions of soil and climate there, that is, by a light rainfall and by a soil which does not retain moisture. The hope of improvement lies in endeavours to hybridise an indigenous variety with the superior Broach or Dhárwár variety. It may be possible that such hybridised plants may retain the rapid maturity of the indigenous parent and acquire the longer staple of the imported parent.

Experiments are being conducted, but their results cannot yet be foreseen; and even if they are successful the process of improvement must take a long period. Further the improvement itself will be limited by the standard of the staple of the superior parent.

8. *Extension.*—In favourable seasons some 600,000 acres more than the present area have been under cotton in Gujarát and may again be placed under cotton, and if the price of cotton was sufficiently remunerative it might be possible that another million acres might be added, representing in all an addition of 300,000 bales.

Sind Cotton.

9. *Extension.*—The area under cotton is only 200,000 acres, but with the advantages of a superior soil and canal irrigation, the outturn is slightly over 100,000 bales. (In Sind less than 2 acres go to a bale, while in the Presidency proper 5 acres go to a bale).

With the construction of Jámráo and other new canals in the Desert the cotton area has doubled in the last five years. The extension of cotton is to some extent retarded by the scarcity of labour in Sind and the fact that cotton gives more trouble to the labourer who has an important voice in determining what crop he will grow. If prices however remain high there is no doubt that the area will considerably expand. Taking all crops together the total area annually cultivated in Sind is 3 million acres and it is possible that during the course of a few years some 500,000 acres may be placed under cotton.

10. *Improvement.*—The present quality is (as cotton) the worse in India, but obtains a fairly high price owing to a roughness of texture which adapts for mixture with wool in Germany to which country almost the whole of the crop goes.

11. The winter frosts command the situation in Sind; for if the cotton is not picked before the frost begins it is destroyed. Since the inundation of the Indus does not begin till May it has been necessary in the past for the Sindhi to cultivate a rapid growing plant which will come to maturity between May and December and he has been debarred from cultivating the long stapled varieties which require eight months to mature.

There is reason to hope that the situation is now entirely changed by the recent construction of perennial canals. We are, however, this season making our first attempt under the changed conditions and it would be unwise to venture on a confident prediction.

The object in view is to sow long stapled cotton in April or even earlier in March and to look for its maturity in November and December. Mr. Fletcher, the Deputy Director of Agriculture, who has recently come from Egypt, is the author of this suggestion and is sanguine that Egyptian cotton sown under these conditions will be successful; he is now in Sind conducting the experiment in which the neighbouring Zamindárs and the officers of the Province from the Commissioner in Sind downwards are taking the keenest interest.

12. It has been the practice hitherto of the Irrigation Department to close the branches even of the perennial canals during March and April for the clearance of silt, but the possibility of effecting a change in the dates of closure was discussed this month at Hyderabad (Sind) at an informal conference of Revenue, Agricultural and Irrigational officers, presided over by Mr. Muir-Mackenzie, the Commissioner in Sind; and it is probable that if Mr. Fletcher's experiments are successful it may be found possible to effect the change in the agricultural season which will be required. The proposed change of seasons is in regard to its effect upon other agricultural crops, a matter of great complexity requiring careful consideration, but it is satisfactory that the conference showed that the scheme will not be obstructed by any engineering difficulties.

If Egyptian cotton can be satisfactorily introduced an area of 500,000 acres cultivated with an outturn of 200,000 bales of cotton suited for the Lancashire market may be confidently anticipated.

13. To sum up:—No immediate addition of supplies can be expected. The limits and conditions of future additions may be summarized—

	Bales.
(1) Sind Egyptian cotton (100 counts) if present experiment succeeds	200,000
(2) Broach and Karnátak cotton (20-35 counts) if prices remain high	50,000
(3) Gujarát and Khándesh cotton (12-15 counts) if prices remain high	300,000
Deduct—	
Sind ousted by Egyptian	—100,000
Total ...	450,000

Total possible increase from 1,000,000 to 1,450,000 bales.

CHAPTER III.

ENTOMOLOGY.

Locusts.

23. The year was marked by a serious recrudescence of the plague of locusts. The last serious plagues occurred in 1882 and 1883, and little definite information was on record regarding the life history of the pest. This year we were fortunate in having

the services of two skilled Entomologists, Mr. Lefroy, Entomologist to the Government of India, who was stationed at Surat, and Mr. Knight who has been temporarily employed in this Department.

The few swarms that were observed in the hot weather of 1903 (*vide* paragraph 21 of the Annual Report for 1902-03) bred in some of the most inaccessible parts of the Thána hills and small swarms appear to have visited Khándesh and the Panch Maháls. In the late autumn the young locusts assumed wings and attacked the standing crops in Thána, Khándesh and parts of Násik, Kolába and the three northern districts of Gujarát. In November they disappeared from Khándesh and Thána, but remained in Násik and Kolába and visited the western parts of Poona, Sátára and Ratnágiri. They lingered in these districts chiefly in the forest-clad hills till March damaging crops and fruit trees.

In April and May the swarms after going to the east appear to have returned to the western ghâts. They found little to eat in the eastern Deccan in May and June and died in large quantities of disease and possibly of starvation.

In June they were observed breeding along the line of ghâts from Kolhápur northwards to Surat; and young locusts have been hatched over large areas in Ratnágiri, Kolába and Thána and in lesser numbers in the western hills of Sátára, Poona, Násik, throughout Khándesh and in parts of Panch Maháls.

24. In March the gravity of the danger threatened attracted attention and Messrs. Lefroy and Knight and the three Assistant Collectors, who were placed on special duty in connection with the plague, undertook experiments for the destruction of the locusts. But though vigorous efforts were made on a large scale with the assistance of the revenue establishments in the affected districts all attempts to destroy the adult winged swarms at this season proved ineffective. Amongst other measures, crops and trees upon which the locusts were settling were sprayed with arsenic, but though many locusts no doubt died from eating the poisoned foliage the expense was prohibitive and in the case of crops there was a considerable risk of the poisoning of cattle. Other swarms were attacked by spraying with kerosine oil and McDougal's sanitary fluid. These spraying operations require a skilful agency for their conduct and reliable supervision; two essential conditions which it was impossible to fulfil over the enormous area of impenetrable forests and inaccessible hills in which the swarms found refuge at the period when they were closely collected. Subsequently when they left the forest regions they spread out and were scattered all over the open fields of the Deccan and were therefore equally impossible to cope with.

25. The following rough calculation was made:—

"A large tree thickly covered with locusts was selected in the early morning by Mr. Knight and 2,000 locusts were destroyed and counted under his supervision.

In a measured acre of land there were 200 such trees and the swarm which was of average dimensions covered 50 acres. In other words it contained 20 millions of locusts.

The entire destruction of such a swarm at the rate of reward of half an anna per seer sanctioned would cost Rs. 2,000.

If we allow one swarm to every 10 square miles of country in accordance with observations taken at Khandála and Mahábaleshvar and if we assume that an area of 350 miles in length and 40 miles in breadth or 14,000 square miles is similarly infested, 28,000 millions of locusts will have to be destroyed, a task which would cost 28 lákhs of rupees."

In addition to those adult locusts which were destroyed by villagers without the payment of rewards, over 130 tons were destroyed on payment representing roughly 60 million units.

In June search was made for the eggs which had been laid out, but except in part of the Kolaba District where the hill tribes having lost their nágli (*Eleusine corocana*) took to the work eagerly for the sake of the Government reward of Re. 1 per seer of eggs, the search proved generally ineffectual. Over 3 tons of weight of eggs were however found in the Kolába District and destroyed, representing, it has been calculated, 300 millions of locusts.

26. It was hoped that when the insects were in the hopper stage greater success would be possible in their destruction. Strenuous efforts are being

made by the district officers, and large sums are being paid in rewards, but it is found that while the hoppers are small the villagers employed on this work are only able to earn a living wage at the high rates of reward of eight annas or Re. 1 per seer varying according to the conditions of the locality.

The Acridium peregrinum or the migratory locust lays its eggs in open sandy plains and when the hoppers appear they form serried columns and march together in a definite direction. They are therefore comparatively easy to deal with on an organised plan.

But with the Acridium succinctum or the Bombay locust the case is different. The young locusts are chiefly produced in the wild and inaccessible hill regions and find secure shelter and ample sustenance in the grass jungles. They do not develop the gregarious instinct until after they assume their wings and it is therefore almost impossible to drive them in a special direction and the operation of catching them in bags is slow, difficult and expensive. The locust is clearly a permanent resident of the Ghát region and the plague is ordinarily kept in check by the forces of nature. It remains to be seen whether the abnormal features of the season of 1904 will be found to be favourable or unfavourable to the reproduction of the plague. It is possible that the winter, when the locust becomes torpid with cold, may afford an opportunity for more successful efforts by human agency.

Grasshoppers.

27. A plague of grasshoppers commenced in Belgaum in the first days of June. Mr. Lefroy visited the locality and after making some ineffectual experiments with sprinkling a solution of kerosine and a mixture of lead arsenic on rice land, recommended the adoption of an open-mouthed bag, which was found successful in the Central Provinces, and is similar to that which was used in the locust plague of 1883 in Thána.

The experiment was conducted throughout June, July and August, and it was calculated that over 13 million young grasshoppers were destroyed.

The Collector of Belgaum then reported that the local villagers showed themselves entirely apathetic in the matter and refused to give any assistance whatever to the labourers employed by Government. In these circumstances he considered it advisable to close the operations.

Other pests.

28. Damage to jowár and sesamum crops by caterpillars was reported from the Upper Sind Frontier District. In the case of sesamum the damage was serious amounting to 12 to 16 annas. The insect attacking jowár has been identified with the moth-borer, *Chilo simplex*, known to attack cane, maize and jowár. The insect attacking sesamum could not be identified without further investigation.

Insect pests were also reported from Ahmedabad, Násik, Kánara, Sukkur, Thar and Párkar and the Government farms at Nadiád, Surat and Poona, the crops affected being bájri, jowári, rice, wheat, til, castor, cotton, and tobacco.

Mr. Lefroy has this season undertaken the special investigation of rice pests.

CHAPTER IV.

Agricultural Education.

College of Science.

29. Orders have not yet been received regarding the appointment of the Professor of Agriculture to the College of Science, but the temporary appointment of Mr. Knight has been continued pending the submission of proposals to the Secretary of State. The appointment has already resulted in a remarkable improvement of the practical work of the students. The students' plots, which are cultivated by the students themselves upon the farm, used formerly to be a blot on the general appearance of the farm, but are now nearly up to the high standard maintained by the paid establishment. The Agricultural Class continues to attract students and whereas

three years ago there were only 15 attending the course, this number has now risen to 49.

Training Colleges.

30. The farms for the teaching of agriculture in the Training Colleges have been started at Ahmedabad and Dhárwár and are in charge of the teachers who were trained last year. The scheme for the Poona College which was linked with the proposal for the transfer of the site of the Poona Farm has been postponed pending the settlement of the larger question. A probationer from Sind has also been in training for the post of teacher at the Hyderabad Training College.

Agricultural Text-Books.

31. The Agricultural Text-Book and the Lessons for village schools have been prepared by Messrs. Mehta and Knight respectively, and are now under the consideration of the Committee for the revision of Educational Text-Books.

Instruction of Probationers from other Provinces of India.

32. Pending the completion of the Pusa Institute the Poona Farm has been utilised for the instruction of probationers from other provinces of India. Seven men visited it from Madras, one from Mysore and one from the Panjáb.

The deputation of these officers is a gratifying recognition of the excellence of the management on the farm. These men have uniformly worked well and the industry and intelligence of the students from the Saidapet College of Madras has in particular received the favourable report of Mr. Knight.

Private Benefaction for training Cultivators' Sons.

33. A useful benefaction from a Bhátia gentleman, Mr. P. V. Mávji, deserves notice. Mr. Mávji presented a sum of Rs. 150 to this Department for the purpose of training 2 sons of Kunbis in practical work on the farm. Two boys have joined the farm from the Poona District.

Instruction of Officers of the Indian Civil Service.

34. A class was started for the first time for the purpose of imparting to junior Civilians some knowledge of the agriculture and agricultural problems of the country. Lectures were given by Mr. Knight and illustrated by the practice of the Poona Farm and of neighbouring cultivators; they aroused the interest of the class, and I am informed that the knowledge acquired has been put to good use by some of these Assistant Collectors in their enquiries regarding suspensions and remissions of revenue. It is hoped also that the course may have some effect in inducing an interest in the improvement of agriculture which is sometimes found wanting in officers who have had no opportunity of studying the subject.

CHAPTER V.

Publication of Agricultural Information.

35. The annual season and crop report has been separately published, containing the agricultural statistics of the Presidency, and the preliminary and final forecasts on wheat, cotton, sesamum, groundnut, linseed and rape-seed have been issued from time to time. The standards of outturn of cotton have been revised in accordance with the more accurate information now on record and efforts have been made to secure more accurate reporting from the subordinate agency which furnishes this statistics. In the case of cotton the fact that some 40 per cent. of the area cultivated is situated in Native States, in which the reporting agency is defective, diminishes the value of the forecast in regard to the varieties of cotton cultivated in those States.

Distribution of Bulletins and Leaflets.

36. In connection with the plague of locusts much valuable information was distributed in leaflets prepared by Messrs. Lefroy and Knight. Extraordinary ignorance was found to prevail amongst the cultivators regarding the origin of the plague. The idea that the locusts bred locally and laid eggs and that the minute hopping insects which were later found in the fields developed into the winged swarms of adult locusts was universally scouted. It is possible that the apathy displayed by cultivators in regard to the destruction of these hoppers may have some connection with their ignorance of the danger which they threaten.

These leaflets were widely distributed throughout the tracts affected and Revenue officers of all grades were instructed in the causes and growth of the plague. It may be hoped that the distribution of correct information on this subject may have some effect in altering the future attitude of the people, for without their co-operation the efforts of the agency at the command of Government must necessarily be frustrated.

Mr. Lefroy also prepared a leaflet suggesting measures for the protection of sugarcane against moth-borer by the cultivation of a fringe of sorghums around the sugarcane. This was translated into Gujaráti and English and Gujaráti copies were distributed. This suggestion has, however, not been found efficacious on the Government farms and cultivators were warned to adopt it only as an experimental measure.

Mr. Lefroy also prepared a leaflet on insects attacking cotton, which are similarly being distributed and published.

Prevention of Smut on Jowári.

Mr. Knight has again published a leaflet on the prevention of smut on jowári by the steeping of the seed in a solution of copper sulphate. This leaflet has been translated into 3 languages, has been distributed to Collectors and communicated to the Vernacular newspapers who have all shown themselves most willing to accept and publish such contributions. It is proposed to repeat the publication of this leaflet at the times for the sowing of jowári, both kharif and rabi, and to issue it to villages. Mr. Knight has also made arrangements with several Vernacular papers for the supply to them of a series of articles regarding the scientific principles underlying agriculture and their practical application. In this he discusses the current native methods of agriculture, compares them with Western methods and includes the results of the experiments which have been demonstrated on the Government farms.

A bulletin on prickly-pear and aloe as fodder for cattle during scarcity prepared by Mr. P. R. Mehta, Deputy Director of Agriculture, was published during the year.

A bulletin containing a classified list of cultivated crops by Mr. W. P. Symonds, I. C. S., late Director, Land Records and Agriculture, and another showing the dates of sowing and harvesting of principal crops in different districts of the Presidency are in the Press and will shortly be published.

37. The establishment of District Agricultural Associations has again been under consideration, and I have been in correspondence with influential native gentlemen in Poona, Sátára and Dhárwár. When the new developments of work that have been undertaken by the Department are more fully organised, it will be possible for Messrs. Fletcher and Knight to give more attention to this important movement. A central organisation is necessary, and I hope that the Agri-Horticultural Society of Western India may be induced to assume this position. These projects are perhaps scarcely appropriate to a report of work done, but I mention them since the preliminary discussions have been held.

I have the honour to be,

Sir,

Your most obedient servant,

H. S. LAWRENCE,

Director, Land Records and Agriculture.

Appendix A.

Operations on Farms and Gardens in the Bombay Presidency.

SURAT.

The rainfall was up to the average but not well distributed. The net cost of working the farm and the dairy is Rs. 2,658 against Rs. 7,070 in the previous year. The farm contains an area of 84 acres and the dairy had a strength of 86 bulls, cows and buffaloes.

2. Five thousand lbs. of seed of various varieties were distributed, chiefly of cotton and groundnut.

3. The Gujaráti bullocks being the finest and best trained for agricultural work in India, 12 were sent to other Provinces of India to demonstrate the advantages that are obtained by such skilful training.

4. A considerable number of implements such as chaff-cutters, drills and bullock hoes was also distributed through the agency of the farm.

5. The farm was visited by 100 cultivators, to whom the experiments were shown and explained.

6. Mr. Fletcher has carefully analysed the results of the series of experiments which have been in progress for the last 6 years. His conclusions are as follows :—

Rotation and Manurial Experiments.

(*a*) Cotton alternating with a mixture of jowár and tuer is the best, cotton alternating with jowár being second best, the value of the yield, less the cost of production of the first, being Rs. 18 and of the second Rs. 16-2 per acre.

(*b*) Mr. Fletcher writes :—

"Fallowing is proved to be a complete failure, whether this is a complete fallow or a fallow after a green manure crop. This emphasizes the general experience of modern agriculture that fallowing in districts of even moderate rainfall is ineconomical, the effect of fallowing being merely to store up water in the soil for the next year's crop. In areas under irrigation, *e.g.*, Sind, fallowing is undoubtedly wrong in practice, and the 'Fallow Rules' in force in Sind by which assessment is not paid during the period of fallow are unnecessary and tend only to induce 'extensive' and ineconomical practices."

Mr. Fletcher will now have an opportunity of putting this theory to a practical test on the farm which is being established at Mirpur Khás in Sind.

(*c*) Farm yard manure is of less value in the retentive soils of Surat than in the lighter soils of other districts.

Experiments were made with the application of nitrate of soda obtained through a London firm. The price at which this manure can be regularly placed on the market requires investigation. The experiment will be repeated in order to ascertain whether the fertilizer can be recommended to the cultivators of this country.

Nitrate of Soda.

7. Experiments were also made with the application of crude nitre obtained in India to rice lands, and Mr. Fletcher concludes that if the rice lands are of a retentive character nitre can be profitably applied.

Crude Nitre.

8. The selection of jowári seed was continued satisfactorily, and the farm seed when sold in the bazár readily commands a superior price.

Selection of Seed.

9. The prevention of smut in jowár by steeping the seed in copper sulphate and other solutions was successfully demonstrated.

Prevention of Smut in Jowár.

10. An unusual experiment in transplanting jowár was most successfully performed.

Transplantation of Jowár.

11. Cotton plots sown with a 24-inch drill yielded better than those sown with the ordinary 18-inch drill.

Cotton Tillage.

12. (1) The local sweet potatoes are preferred in the bazár to the American sweet potatoes grown on the farm, the former being considered the sweeter.

Introduced Plants (Sweet Potatoes).

(2) Of the several varieties tried, the Virginian variety has again been far the best. Groundnut cultivation is better suited for light soils than the heavy soils of the farm on which the cost of collecting the nuts comes to Rs. 44 per acre.

Groundnuts.

NADIA'D.

13. The rainfall was only two-thirds of the average. The late rains failed and there was a severe pest at the end of December which did much damage. In consequence the experiments conducted proved inconclusive. A new area of about 44½ acres was taken up during the year, but work on it was necessarily confined to clearing operations. Experiments were continued on the old area on the same lines as in previous years.

DHULIA.

14. At Dhulia a small area of 6 acres was taken up. Several varieties of cotton and jowár new to the district were tried. The Chapti variety of jowár gave the best outturn, and the cultivators were very keen to obtain its seed.

An investigation of the relative yield of local types of cotton was begun and a commencement was made in the hybridization of cottons in the district into which their introduction is to be attempted. The farm has now been transferred to Jalgaon.

CHHA'RODI.

15. The rainfall was not favourable. The Broach and Goghári varieties gave a much better outturn than the local varieties, but it remains to be seen whether they will maintain their position in an average season.

POONA.

16. The rainfall was below normal but the season was fairly favourable. On an area of 35 acres the net cost was Rs. 4,148 as compared with Rs. 2,469 of last year. The increase of cost is due to the botanical and hybridization experiments, which are necessarily unproductive.

17. Experiments were continued in the growth of forage crops for the use of the dairy. The yield of the different varieties of sorghums varies according to the conditions of the rainfall of different years.

Forage Experiments.

Mr. Knight is inclined to recommend a more extensive use of maize as a green fodder crop under irrigation, apparently for the reason that "it can be fed at any stage, while hundi jowár is a dangerous food if given to cattle before it is bloomed." Some of the cattle were poisoned by hundi jowár this season, two cattle dying, and in the samples of fodder forwarded to Dr. Leather, Agricultural Chemist to the Government of India, was discovered a considerable quantity of prussic acid.

An attempt was made to find a leguminous fodder, but the first trial with san (*Crotolaria juncea*) which is used for this purpose in Madras was unsuccessful. The experiment will be repeated.

18. Mr. Fletcher selected plants from the hybrids grown from the previous year's cross-fertilization. Botanical investigation in the classification of cottons, wheats and tuors was conducted by Mr. Gammie whose voluntary assistance in this laborious task was most valuable.

Botanical Experiments.

19. A number of new plants were tried, and experiments in the methods of cultivation commenced under the direction of the Inspector General of Agriculture.

20. Twenty-five experiments were conducted on lands lent by or hired from cultivators in the application of nitre to rice in different localities in Thána, Kolába and Poona. The results varied greatly and further experiments are required. The conduct of experiments on lands outside the farm is a new departure. It is attended with considerable difficulties which were successfully overcome by Mr. Knight. On the whole Mr. Knight concludes that nitre can be applied with useful results. It has not yet, however, been ascertained from the Inspector General of Agriculture whether in the event of the application being proved to be successful nitre can be placed on the market in commercial quantities.

Experiments on private lands.

21. An experiment was tried in spraying groundnut with Bordeaux mixture as a preventative of the *tika* disease. The field had been diseased in the previous year and the result of an application costing about Rs. 7-8-0 per acre was to raise the outturn from 900 lbs. to nearly 1,600 lbs. per acre, *i. e.*, from a value of Rs. 52 to Rs. 92 per acre. The operations were directed by Dr. Butler, Cryptogamic Botanist to the Government of India.

Fungicides.

A second experiment under Dr. Butler's guidance in treating tuor for wilt disease with sulphate of iron was unsuccessful.

22. Ten reversible iron ploughs and 10 chaff cutters were supplied from the farm to various portions of the Presidency, including Bárámati, Dhárwár, Sátára, and Ahmedabad, a fact which indicates the extending influence of the farm operations.

Distribution of Implements.

Digitized with financial assistance from the Government of Maharashtra on 11 July, 2017

Dairy Farm.

23. Mr. Knight who has had actual experience of dairy management in America has effected a considerable improvement in the management of the herd and the milk supply. Greater attention has been given to the importance of breeding from animals of a superior milk-producing strain, and since the date of his report all animals which were insufficiently productive have been disposed of.

24. The dairy herd hitherto consisted chiefly of Sindhi cows with a mixture of Adens, but since the dairy is maintained largely for the purpose of instruction arrangements are now being made for the introduction of other milk-breeds, such as cows from the Gir in Káthiáwár. It is remarkable that the best milk-giver in the dairy is a half-bred English and Aden cow. The buffaloes consisted chiefly of the Surat or Nadiád variety, and Jafferábadi and Delhi buffaloes are now being introduced. The greatest care is taken to prevent any mixture of the breeds taking place in the grazing grounds.

The net profits of cows have varied from a minus quantity to over Rs. 200 and of buffaloes from a minus quantity to over Rs. 300 per annum, the average being Rs. 69 for cows and Rs. 63 for buffaloes.

MANJRI.

25. The season was on the whole favourable to cultivation but unfavourable for the conduct of experiments owing to the continuous rain from 5th July to 5th August. The net cost of the farm of 45 acres was Rs. 1,100 as compared with Rs. 2,982 in the previous year. There has been a marked improvement in the prices obtained by the sale of farm produce under the careful supervision which has been exercised by Mr. Knight.

Distribution of Seeds.

26. The farm has extended its influence as a distributing agency widely, the chief items being maize seed sent to Sind, Khándesh, Madras, Káthiáwár and Central Provinces; sweet potato cuttings sent to Native States and districts in the Deccan, the Central Provinces, Madras and Assam; sugarcane sets sent to Madras, the United Provinces and Lower Bengal.

Manure Experiments.

27. The results have been chiefly negative. Chili saltpetre and some special manures proved unsatisfactory for sugar-cane, maize, jowár and bájri.

New Methods of Cultivation.

28. In regard to sugarcane the Mauritius system of planting and West Indian system of trashing gave no improvement over the local practices.

Tillage.

29. The failure of the experiments in tillage noted by Mr. Knight exemplified the difficulty of obtaining rapid results from agricultural experiments in India which are liable to be nullified either by some slight carelessness on the part of a subordinate or by unseasonable weather.

Flax.

30. An interesting experiment was made in the cultivation of linseed for fibre. Good flax has never yet been obtained in India, and the experiment deserves to be repeated from year to year till a definite conclusion can be formed.

Sweet Potatoes.

31. American sweet potatoes which have succeeded very well on rich soils proved to be unsuitable to light soil. The Nansemond variety on a good soil gave an yield of over 30,000 lbs. per acre worth over Rs. 200 with a cost of cultivation of about Rs. 100. On light soils the outturn is less than one-third of this.

New Crops.

32. New crops tried included Canary seed, Egyptian clover, West Indian sweet potatoes, and American cottons and several varieties of beans. None of these succeeded. A careful comparison of varieties of tapioca is under investigation. Other experiments with Shálu jowár and 66 varieties of wheat failed owing to the character of the year.

Indian long-stapled Cottons.

33. A very interesting result was obtained from the cultivation of the Broach and Kumpta varieties of cotton under irrigation. These gave a return of from 900 to 1,000 lbs. of seed cotton per acre valued at Rs. 70 to Rs. 80. This experiment has been brought to the notice of the Revenue officers and Irrigational Engineers of the Deccan, and Mr. Knight has induced an enterprising landowner on the Nira Canal to make an experiment in this season.

MANJRI SEWAGE FARM.

34. On an area of 14 acres the cost of cultivation was Rs. 2,301 and the outturn Rs. 3,022, leaving a net profit of Rs. 721. In addition the cost of purifying the sewage was Rs. 4,467.

35. Sugarcane was attacked by a borer insect and a considerable portion of it was destroyed. The surans were also attacked by a disease. The ginger was also attacked by a disease and the price obtained was very low. Turmeric, groundnut and sweet potatoes gave the largest outturn. The fodder crops of sorghums and maize were also satisfactory.

H. S. LAWRENCE,
Director, Land Records and Agriculture.